

STATE OF ALASKA

*William A. Egan, Governor*



Annual Progress Report for

LIFE HISTORY INVESTIGATIONS OF NORTHERN PIKE  
IN THE TANANA RIVER DRAINAGE

*by*

*William L. Cheney*

ALASKA DEPARTMENT OF FISH AND GAME

*James W. Brooks, Commissioner*

DIVISION OF SPORT FISH

*Rupert E. Andrews, Director*

*Howard E. Metsker, Coordinator*

# ANNUAL REPORT OF PROGRESS

## TABLE OF CONTENTS

	<u>Title</u>	<u>Page No.</u>
Job R-III-A	Pike Distribution, Movement, and Population Indices.	3
Job R-III-B	Pike Utilization in the Tanna River Drainage.	7
Job R-III-C	Pike Spawning Habits.	13
Job R-III-D	Pike Age and Growth and Racial Studies.	15
Job R-III-E	Limology, Productivity, and Food Habits Study.	21

RESEARCH PROJECT SEGMENT

*State:* Alaska

*Project No.:* F-9-4

*Name:* Sport Fish Investigations of Alaska

*Study No.:* R-III

*Study Title:* Life History Investigations of  
Northern Pike in the Tanana River  
Drainage.

*Period Covered:* July 1, 1971 to June 30, 1972.

ABSTRACT

Northern pike, Esox lucius, are distributed throughout the Tanana River drainage.

Minto Flats pike appear to move downstream into the lower Tolovana and/or Tanana rivers to overwinter and return in the spring to spawn.

Creel census information in Minto Flats reflects a declining fishing pressure and catch since 1969. Anglers caught an estimated 246 pike, and subsistence fishermen in Minto Flats took an estimated 450 pounds of pike in 1971.

Scales of immature pike (age 0 through III) were easily interpreted. Scales of older pike are more difficult to read. Minto Flats pike have a faster growth rate than pike from Great Bear, Great Slave, Lesser Slave, and Athabaska lakes, Canada. Pike from George and Healy lakes, Tanana River drainage, grow slower than Minto Flats pike.

Limnological data from the Minto Flats are presented.

Comparative meristics of three Tanana drainage pike populations show significant differences among these groups.

## RECOMMENDATIONS

That this project be terminated with the following exceptions which will be incorporated into the Chatanika River study.

- a. Continue the Minto Flats creel census and monitor the subsistence fishery.
- b. Locate pike spawning grounds in the Minto Flats.

## TECHNIQUES USED

Northern pike were captured using graduated mesh gill nets, constant mesh gill nets (4- and 5-inch stretched mesh), and sport angling gear. Collection of pike with a boat-mounted alternating current shocker similar to that described by Van Hulle (1968) was attempted.

Preserved pike were fixed in 10% formalin for several days, then stored in 40% isopropyl alcohol.

Pike were tagged with Floy yellow plastic dart and anchor tags. Recaptures were made by Department personnel and subsistence and sport fishermen.

Sport fishing pressure was estimated by a statistically based creel census. Angler interviews were conducted to estimate harvest.

Subsistence fishery estimates were made from angler interviews and counts of nets and fish taken.

Scales and the first four to eight vertebrae were taken for age determination. Scales were mounted between glass slides and read with the aid of a microprojector. Vertebrae were cleaned, dried, separated, placed in a clearing agent (cedarwood oil) and read with the aid of a binocular microscope.

Meristic counts follow the techniques of Hubbs and Lagler (1958).

Water temperatures were taken with hand and electric thermometers. Water chemistry was determined with a Hach Model AL-36-WR test kit.

Invertebrate samples were collected with hand dip nets.

## FINDINGS

### *Job R-III-A Pike Distribution, Movement, and Population Indices*

#### Objectives

1. To determine seasonal movements of pike.
2. To determine distribution of pike in the Tanana River drainage.
3. To obtain population estimates for selected waters in Minto Flats.

#### Seasonal Movements

Gill nets were set in various locations in Minto Flats on May 17, 1971. On May 19, one spent female northern pike, Esox lucius, was captured at the mouth of Uncle Sam Creek. Test netting was conducted intermittently until freeze-up (October 5) and under the ice in November and December. Table 1 shows catch statistics from May 17 through December 9. The majority of effort was expended in the western part of Minto Flats.

TABLE 1 Test Netting Results, Minto Flats, 1971.

<u>Date</u>	<u>Net Hrs.</u>	<u>Pike Caught</u>	<u>Pike/Hr.</u>	<u>Other Fish Caught*</u>	<u>Total Other Fish/Hr.</u>
5/17-31	307	10	0.03	117	0.38
6/ 1-15	92	4	0.04	23	0.25
6/16-31	--	--	--	--	--
7/ 1-15	126	94	0.75	39	0.31
7/16-31	158	73	0.46	14	0.09
8/ 1-15	12	--	0.00	3	0.25
8/16-31	--	--	--	--	--
9/ 1-15	105	34	0.32	7	0.07
9/16-31	261	164	0.63	31	0.12
10/ 1- 5	38	15	0.39	17	0.45
11/19-12/9	476	49	0.10	2	<0.01
	1,575	443		253	

\*Includes grayling, Thymallus arcticus; whitefish, Coregonus sp.; sheefish, Stenodus leucichthys; suckers, Catostomus catostomus; blackfish, Dallia pectoralis; burbot, Lota lota.

The extremely low catch per unit effort during the spawning period (approximately May 15 to June 15) may be related to low densities rather than low populations. Flooding occurred during this period and approximately half of the 800-square-mile Minto Flats was inundated. This greatly increased the available fish spawning habitat and allowed fish to spawn in areas inaccessible to gill netting.

When spawning was completed, mature pike moved into deeper water where they could be sampled with gill nets and the catch per unit effort increased. Pike may remain in these areas during the entire summer (Alt, 1970).

During late September, test netting revealed extensive movements of pike that appeared to be out-migrations. From September 21-24, 167 pike were caught in 255 net hours (0.65 fish per hour). During this time, four gill nets were fished continuously in four locations, two in Rock Island Slough and one each at the mouths of the Tatalina and Chatanika rivers. One hundred twelve fish were tagged and one was recaptured during this time. This indicates that fish were moving through the area. Also, fish caught in the two nets in Rock Island Slough were headed downstream. Both mature and immature pike were taken in four locations: 73 (44%) were immature (less than four years old). The remainder represented age classes V through XIX. The length range of all fish was 163 - 950 mm with a mean of 554 mm (n=121).

In November, residents sport fishing through the ice of the Tolovana River below New Minto reported taking approximately 80 pike. From their descriptions all were immature pike probably under 300 mm in length.

From November 19 to December 9, a gill net was fished beneath the ice at the Chatanika River mouth. In 476 net hours, 49 pike, 1 whitefish, and 1 blackfish were taken. The length range of 45 pike was 160 - 470 mm ( $\bar{x}$ =265 mm). Females comprised 49% of the pike catch while 51% were males. All were immature except the 470 mm female.

#### Pike Tagging:

A tagging program initiated in 1967 and continued through 1971 has resulted in 1,542 pike tagged with metal jaw tags, Peterson disc tags, plastic dart tags or plastic anchor tags. One hundred one have been recovered. Only 12 were recovered in 1971. Table 2 summarizes tagging data for the years 1967 through 1971.

TABLE 2 Northern Pike Tagged and Recaptured, Minto Flats, 1967-1971.

<u>Year</u>	<u>No. Pike Tagged</u>	<u>Cumulative Tagged</u>	<u>No. Recaptured</u>	<u>Cumulative Recaptured</u>
1967	201	201	4	4
1968	228	429	7	11
1969	606	1,035	42	53
1970	378	1,413	36	89
1971	129	1,542	12	101

Of the 129 pike tagged in 1971, 112 were tagged between September 21 and 24, as they were apparently leaving Minto Flats. The remainder were tagged in July.

The two pike tagged and recaptured in 1971 were recovered at the capture location, Rock Island Slough, one day after tagging.

Tag recaptures in past years (Alt, 1970; Cheney, 1971) show that a few pike may move long distances during the summer but most tend to remain in the same area.

#### Movements Summary:

In spring pike ascend the rivers of Minto Flats beneath the ice. As the ice begins to melt in the shallows, pike commence spawning. In 1970 (Cheney, 1971), spawning began on approximately May 10. After spawning, pike disperse and may remain in one area the entire summer. In the fall, usually late August, decreasing air temperatures and photoperiod are coincident with falling water temperatures and levels. As the waters approach freezing, the mature pike begin moving downstream. By early winter, most of the mature pike are probably in the lower Tolovana River (below Swanneck Slough) or the Tanana River. Immature pike remain longer in the main rivers of the Flats. By late winter, decreasing dissolved oxygen has probably forced these fish to seek more favorable locations downstream.

#### Distribution

In general, pike are distributed throughout the waters of the Tanana River drainage. They have been taken in headwater streams such as the Chisana River as well as waters near the mouth (Fish Lake). Pike are present in nearly all major lakes, George, Healy, Tetlin, Mansfield, etc., as well as most of the smaller lakes. Most Tanana River tributaries contain pike populations, at least during summer.

## Population Indices

Unsuccessful attempts were made to obtain sufficient pike samples to make population estimates for selected areas in the Minto Flats. Bear Paw Slough, Rock Island Slough, and Minto Lake were sampled with a boat-mounted alternating current shocker. Although this shocker has captured fish efficiently in other Interior lakes and streams (Peckham, 1972) and functioned normally in our operations, only two pike were obtained in eight hours of operation. The extremely high water level and low fish densities in 1971 were probably responsible for the low efficiency experienced with the shocker.



## *Job R-III-B Pike Utilization in the Tanana River Drainage*

### Objectives

1. To monitor the sport fishing effort and catch in the Minto Flats.
2. To determine trends in length frequency of sport-caught fish.
3. To survey the subsistence fishery of Minto Flats.

### Creel Census

Minto Flats was divided into three census areas on the basis of past-observed use and accessibility: (a) the Chatanika-Tolovana area consists of the Tolovana River, from approximately four miles below New Minto, to the mouth of Swanneck Slough; the Chatanika River from its mouth upstream to the mouth of Birch Creek, and the Tatalina River from its mouth upstream to the mouth of Washington Creek (Figure 1); (b) the Windy Lake area includes the Tolovana River from approximately four miles below New Minto to approximately 15 miles above New Minto and connecting waters; (c) the Minto Lakes area consists of the Chatanika River from the mouth of Birch Creek upstream to the river's entrance into Minto Flats and includes Minto Lakes and Goldstream Creek.

Access to the Flats is either by float plane, boat, or auto.

A statistically based creel census, similar to Roguski and Winslow (1969), was conducted in Minto Flats from June 16 through August 17, 1971. The period from June 16 through July 15 was stratified as follows to provide better coverage during high use periods.

<u>Strata</u>	<u>% of Periods Sampled</u>
Weekdays ( 8 AM - 10 PM)	31.1
Weekdays (10 PM - 8 AM)	4.7
Weekends ( 8 AM - 10 PM)	50.8
Weekends (10 PM - 8 AM)	8.9

Sampling was further stratified to give 20% of the total census effort to the Minto Lakes area and 40% each to the other areas.

The census from July 17 through August 17 was modified as follows:

The census in the Chatanika-Tolovana and Windy Lake areas was restricted to weekend days between 5 AM and 8 PM, as previous censusing indicated virtually no fishing effort at other times.

Census effort in the Minto Lakes area was increased to eight days including four weekend days, as previous censusing showed more fishing pressure there than in the other areas. A blanket census was conducted on the sample days.

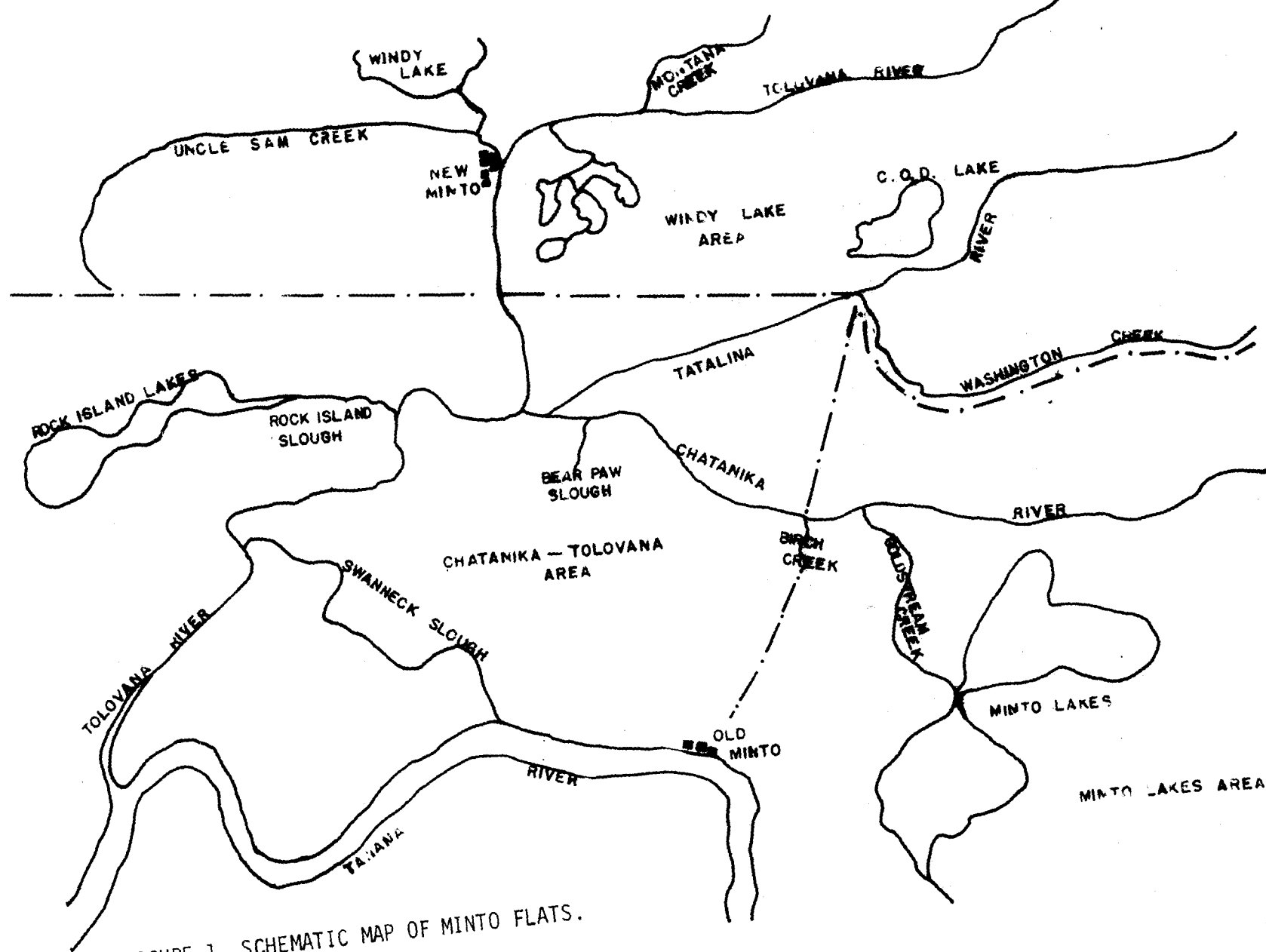


FIGURE 1 SCHEMATIC MAP OF MINTO FLATS.

In 1971, 1,803 angler hours were expended in the Minto Flats (Table 3).

TABLE 3 Estimates of Sport Fishing Pressure, Minto Flats, June 15 - August 17, 1971.

Area	Angler-Hrs.						Total
	6/15 - 7/16			7/17 - 8/17			
	Boat	Plane	Total	Boat	Plane	Total	
Windy Lake	69	32	101	0	0	0	101
Chatanika - Tolovana	458	21	479	47	0	47	526
Minto Lakes	<u>268</u>	<u>241</u>	<u>509</u>	<u>557</u>	<u>110</u>	<u>667</u>	<u>1,176</u>
Total	795	294	1,089	604	110	714	1,803

Angler interviews indicated that boat fishermen fished 4.9 hours per trip while plane fishermen averaged 2.6 (Table 4). Expanding the angler interview data from Table 4 to the entire 1,803 angler hours gives an estimated catch of 246 pike.

TABLE 4 Results of Angler Interviews, Minto Flats, June 15 - August 17, 1971.

	Boat	Plane
Parties interviewed*	25	13
Anglers interviewed	69	28
Mean anglers per party	2.8	2.2
Angler-hours	335	73
Pike caught	50	8
Pike retained	49	2
Percent pike retained	98	25
Pike caught per hour	0.15	0.11
Mean hours per trip	4.9	2.6

Residency Status\*\*

<u>Alaska Resident</u>	<u>Military</u>	<u>Tourist</u>	<u>Unknown</u>
27 (52.9%)	20 (39.2%)	1 (2.0%)	3 (5.9%)

\*Includes only anglers who had finished fishing.

\*\*Includes anglers who had not completed their trips.

Table 5 compares Minto Flats sport fishing pressure estimates from 1969 through 1971. There has been a decrease in both fishing effort and catch since 1969, probably due to the high water.

TABLE 5 Comparative Sport Catch, Minto Flats, 1969-1971.

	<u>1969</u>	<u>1970</u>	<u>1971</u>
Angler-hours	3,198	2,133	1,803
Pike caught	6,199	958	246
Pike retained	1,359	604	209
% pike retained	22	63	boat - 98 plane- 25

#### Length Frequency

Fifty-five pike caught by boat fishermen were measured to determine length frequency. These ranged in length from 22.3 - 85.0 cm with a mean of 55.0 cm.

#### Subsistence Fishery, Minto Flats, 1971

Subsistence fishing in Minto Flats began the first week of June, approximately two weeks after ice breakup. Effort was largely terminated by the end of July as weekly observations in August and September showed no fishing.

Interviews with subsistence fishermen were attempted during the summer but little useful information was gained. People interviewed stated that most pike were used for dog food but that sheefish and whitefish were used for human consumption.

The complex of lakes, sloughs, and rivers near New Minto was the primary site of the subsistence fishery. Interviews, observations, and past knowledge of the fishery indicate that the observed catch was approximately 50% of the total catch. The bulk of the pike subsistence catch (an estimated 136) was taken in four nets fished by three families (Table 6).

TABLE 6 Estimated Subsistence Catch, Minto Flats, 1971.

<u>Species</u>	<u>June</u>	<u>July</u>	<u>August</u>	<u>September</u>	<u>Total</u>
Pike	14	122	0	0	136
Whitefish	20	88	0	0	108
Sheefish	<u>0</u>	<u>2</u>	<u>0</u>	<u>0</u>	<u>2</u>
	34	212	0	0	246

Forty-eight pike from this fishery were measured to determine length frequency. These fish ranged from 31.0 - 94.6 cm in length ( $\bar{x}=57.3$  cm). A pike of 57 cm weighs approximately 1.5 kg (3.3 pounds); thus, an estimated 450 pounds was taken.



*Job R-III-C Pike Spawning Habits*

Objectives

1. To locate spawning grounds, determine spawning dates, observe spawning behavior and determine optimum spawning habitat of pike in Minto Flats.
2. To determine reproductive potential of pike in Minto Flats.

Extreme flooding in Minto Flats for the entire 1971 spawning period precluded the completion of this job.

Approximately 50% of the Minto Flats was submerged to varying depths. All previously known spawning areas adjacent to Minto Lakes and in Rock Island Slough and Bear Paw Slough were under three to six feet of water. Suspected spawning areas in 1971 were in thick brush and heavy emergent aquatic vegetation. Standard sampling methods were ineffective. Gill nets were fished 398 hours from May 17 to June 15, but no gravid pike were taken. The 14 pike caught were spent. During this time in 1970, approximately 120 pike were taken and gravid females were taken as late as June 16 (Cheney, 1970). However, it appears that most pike spawn in mid-May.

Pike prefer shallow waters for spawning. In 1970, pike were observed spawning in water from three inches to two feet in depth.





*Job R-III-D Pike Age and Growth and Racial Studies*

Objectives

1. To compare ages and growth rates of pike from various waters.
2. To determine if racial differences exist among various waters.

Pike samples from the 1970 and 1971 field seasons are combined in the age and growth study.

Age determination using scales was critically re-examined. Pike scales age classes 0 through V can be utilized for age determination. However, vertebrae were used for age determination since they are easier to interpret in older fish and appear to be less subject to the formation of false annuli. Pike scales have a tendency to accumulate false annuli due to unfavorable environmental conditions (Williams, 1955). It is difficult to distinguish false from true annuli due to the extreme crowding of circuli. Ages of Minto Flats pike determined by both methods agree well to age V. Beyond age VI, there is increasing disagreement.

Scales of pike from George, Healy, East Twin, and West Twin lakes were easier to read than those from Minto Flats, because annuli were more distinct.

Table 7 presents data on age and growth of pike in Minto Flats. These fish grow faster than pike from Great Bear, Great Slave, Lesser Slave, and Athabaska lakes, in Canada (Miller and Kennedy, 1948).

TABLE 7 Age and Length of 236 Pike, Minto Flats, 1970-1971.

Age Class	n	Length (mm)	
		Range	Mean
0 - June-July	31	33 - 104	62
- August	3	112 - 124	117
- September	14	117 - 170	140
I - July	15	126 - 171	146
- Aug.-Sept.	5	164 - 202	186
II	27	249 - 372	287
III	11	287 - 380	341
IV	16	360 - 580	459
V	29	415 - 680	555
VI	13	585 - 750	665
VII	22	540 - 795	629
VIII	17	640 - 855	724
IX	13	690 - 850	795

TABLE 7 (Cont.) Age and Length of 236 Pike, Minto Flats, 1970-1971.

Age Class	n	Length (mm)	
		Range	Mean
X	4	740 - 870	801
XI	2	820 - 825	823
XII	4	835 - 925	873
XIII	1	890	-
XIV	1	915	-
XV	0	---	-
XVI	4	920 - 956	939
XVII	0	-	-
XVIII	0	-	-
XIX	1	940	-
XX	0	-	-
XXI	2	915 - 1065	990
XXII	0	-	-
XXIII	1	1032	-

Minto Flats pike in their second year (age I) had reached a mean length of 153 mm (combined July, August, and September data from Table 7). Pike of age I from the four Canadian lakes had mean lengths of 95, 106, 100, and 135 mm. At age V, Minto Flats pike attained a mean length of 555 mm while pike from Canada had mean lengths of 388, 337, 350, and 422 mm. The growth rate of Minto Flats pike is fairly constant to approximately age V when it begins to decrease (Figure 2). Males begin maturing at age III and females at age IV. By age VI both sexes are mature.

Pike growth data from five waters of the Tanana River drainage are presented in Figure 2. Healy and George lakes drain into the upper Tanana River. East and West Twin lakes drain into the Kantishna River which enters the lower Tanana River. All but Healy Lake are deep lakes. Healy Lake has an environment similar to Minto Flats. Pike from Healy, George, East Twin, and West Twin lakes have similar growth rates which are slower than Minto Flats pike but which approximate growth of pike from the Mackenzie River drainage, Canada (Hatfield, et al., 1972).

#### Meristics

Table 8 presents frequency of occurrence of various meristic counts in pike from three different waters of the Tanana River drainage. These counts show little difference between fish from Minto Flats and Healy Lake. These two waters have similar environments with warm, shallow, weedy water.

Pike from George Lake exhibit significant differences for all mean counts except pelvic fin rays and mandibular pores compared to pike from the other two areas.

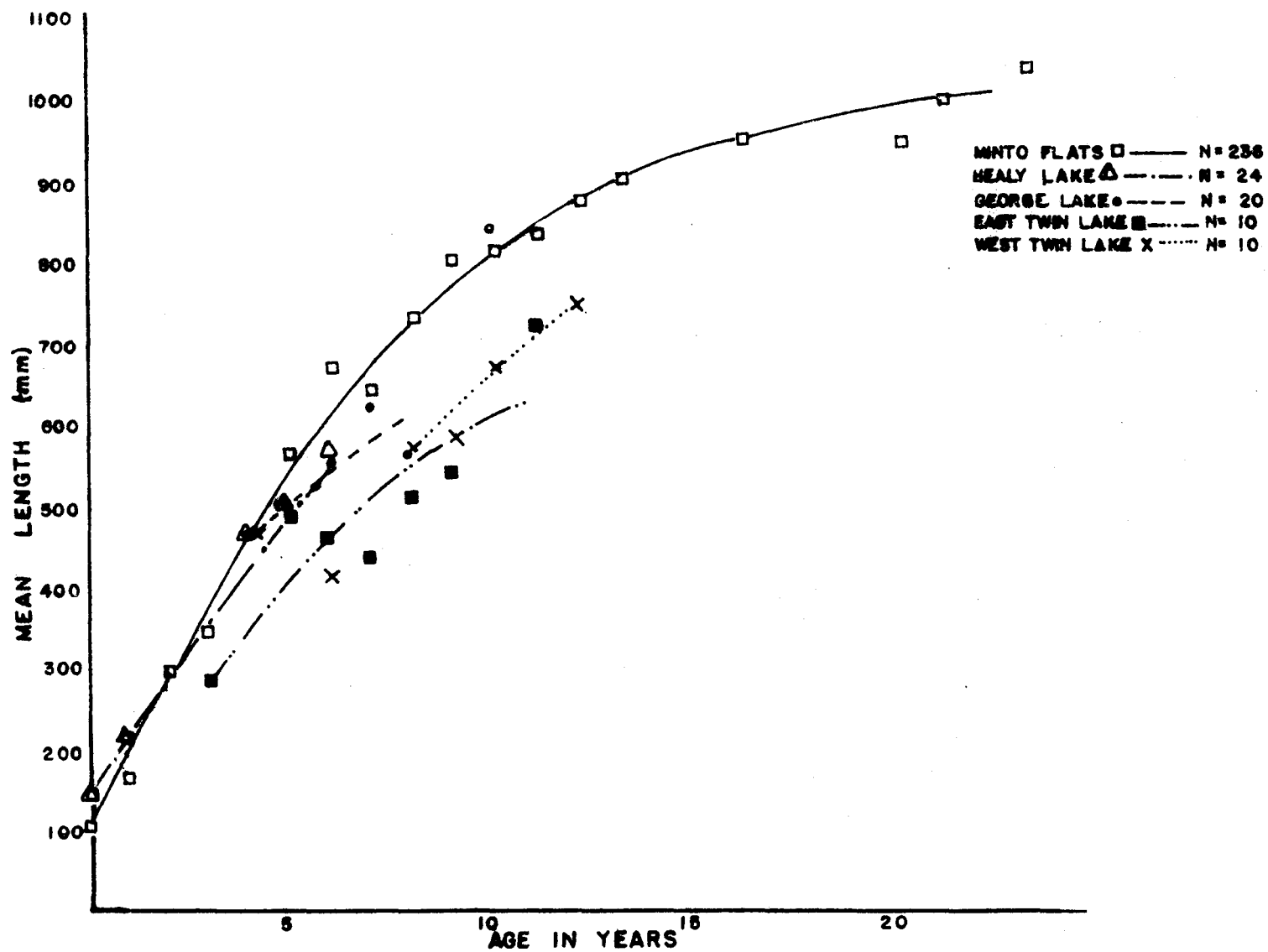


FIGURE 2 AGE LENGTH OF 300 PIKE FROM TANANA RIVER DRAINAGE, 1970 AND 1971.

The differences in counts were not expected. Morrow (1964) reported no difference in meristic counts of pike from upper Yukon River tributaries. George and Healy lakes both drain into the upper Tanana River. Their outlets are 20 miles apart. Minto Flats is on the lower Tanana River approximately 180 miles from Healy Lake.

TABLE 8 Frequency of Occurrence of Meristic Counts of Pike, Tanana River Drainage.

Dorsal Fin Rays										
No. of Rays	<u>15</u>	<u>16</u>	<u>17</u>	<u>18</u>	<u>19</u>	<u>20</u>	<u>21</u>	<u>22</u>	<u><math>\bar{x}</math></u>	<u><math>n</math></u>
<u>Area</u>										
Minto Flats	-	-	-	6	7	13	9	1	19.8	36
Healy Lake	-	-	-	2	3	13	1	1	19.8	20
George Lake	1	7	2	-	-	-	-	-	16.1	10

Anal Fin Rays										
No. of Rays	<u>12</u>	<u>13</u>	<u>14</u>	<u>15</u>	<u>16</u>	<u>17</u>	<u>18</u>	<u>19</u>	<u><math>\bar{x}</math></u>	<u><math>n</math></u>
<u>Area</u>										
Minto Flats	1	-	2	12	15	4	1	1	15.7	36
Healy Lake	-	-	2	6	5	7	-	-	15.9	20
George Lake	3	4	1	1	1	-	-	-	13.3	10

Pectoral Fin Rays ( $P_1$ )									
No. of Rays	<u>11</u>	<u>12</u>	<u>13</u>	<u>14</u>	<u>15</u>	<u>16</u>	<u>17</u>	<u><math>\bar{x}</math></u>	<u><math>n</math></u>
<u>Area</u>									
Minto Flats	-	-	4	6	15	9	2	15.0	36
Healy Lake	2	-	3	3	9	2	1	14.4	20
George Lake	1	1	3	5	-	-	-	13.2	10

Pelvic Fin Rays ( $P_2$ )									
No. of Rays	<u>9</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u><math>\bar{x}</math></u>	<u><math>n</math></u>			
<u>Area</u>									
Minto Flats	-	15	15	6	10.8	36			
Healy Lake	-	7	13	-	10.7	20			
George Lake	2	5	2	1	10.2	10			

TABLE 8 (Cont.) Frequency of Occurrence of Meristic Counts of Pike, Tanana River Drainage.

	Mandibular Pores						
	4 + 3		5 + 4		6 + 5		
	or		or		or		
	<u>3 + 4</u>	<u>4 + 4</u>	<u>4 + 5</u>	<u>5 + 5</u>	<u>5 + 6</u>	<u><math>\bar{x}</math></u>	<u>n</u>
Area							
Minto Flats	1	2	3	25	1	4.8 + 4.9	32
Healy Lake	-	-	2	18	-	4.9 + 5.0	20
George Lake	-	-	-	10	-	5 + 5	10

	Vertebrae								
	<u>55</u>	<u>56</u>	<u>57</u>	<u>58</u>	<u>59</u>	<u>60</u>	<u>61</u>	<u><math>\bar{x}</math></u>	<u>n</u>
Area									
Minto Flats	-	1	1	7	7	14	3	59.2	33
Healy Lake	1	-	1	1	1	7	7	59.8	18
George Lake	1	5	1	2	1	-	-	56.7	10



## *Job R-III-E Limnology, Productivity, and Food Habits Study*

### Objectives

1. To determine chemical, physical, and biological parameters of the important pike waters of the Tanana River drainage.
2. To study food habits of pike.

### Limnology

Water samples from the Tanana River drainage in 1971 were analyzed and results combined with data from 1968 through 1970 (Table 9).

These waters are all moderately hard to very hard. Most waters contain large populations of invertebrate fauna and thick planktonic and other aquatic flora.

Representatives of the following invertebrate groups have been sampled or observed in the waters of the Tanana River drainage: Porifera (sponges), Bryozoa (moss animals), Notostraca (tadpole shrimps), Cladocera (water fleas), Copepoda, Ostracoda (seed shrimps), Amphipoda (scuds), Hydracarina (water mites), Plecoptera (stone flies), Odonata (dragon flies, damsel flies), Hemiptera (water bugs), Trichoptera (caddis flies), Coleoptera (beetles), Diptera (flies, mosquitos, midges), Gastropoda (snails), and Pelecypoda (mussels).

No biological limnology has been attempted during the winter months. However, dense populations of freshwater shrimp (*Gammarus* sp.) were observed prior to and after ice breakup in 1970 and immediately after breakup in 1971. These populations decrease and seem to stabilize during the summer.

Few lakes in Minto Flats retain water over the winter. Windy Lake, C. O. D. Lake, Minto Lakes, and Rock Island Lake retain varying water depths, none exceeding one meter. These lakes may become anoxic in late winter and their outlets freeze to the bottom. The main rivers, Chatanika, Tatalina, and Tolovana, continue to flow and stabilize at depths of 3 - 5 m. These rivers lose dissolved oxygen quickly when ice forms. By November 11, 1971, 35 days after freezeup, the dissolved oxygen in the Tolovana River one mile below New Minto was 1.8 ppm.

Swanneck Slough, entering the Tolovana River from the Tanana River, may, bring water with a higher dissolved oxygen content into the lower Tolovana River (Alt, 1969).

<u>Water</u>	<u>Date</u>	<u>Surface Water Temp. °C</u>	<u>pH</u>	<u>D.O.</u>	<u>CO<sub>2</sub></u>	<u>Total Acid</u>	<u>Total Alkalinity</u>	<u>Hardness</u>	<u>Water Condition</u>
<u>Minto Flats</u>									
C.O.D. Lake	4/26/71	--	6.7	1.5	20.0	68.4	120	103	Ice 35", water depth 42"
Minto Lake	7/29/70	18	8.8	10.0	5.0	0.0	120	86	Ice in N. W. part of lake
	5/25/71	10	7.0	9.0	12.5	--	51	51	
Windy Lake	11/18/70	--	6.8	9.0	--	--	--	--	Ice 18", snow 4"
	6/ 6/71	19	7.0	9.0	10.0	11.3	51	51	Clear, brown
	11/18/71	--	6.7	11.5	10.0	--	103	120	Ice 13-17"
Chatanika R. (50 yds above mouth)	2/27/68	--	--	2.5**	--	--	--	--	Ice 27", snow 6", water depth 12'
Chatanika R. (at entrance to "Flats")	7/15/70	16	8.7	10.5	7.5	--	86	--	Clear, brown
Chatanika R. (200 yds up from mouth)	7/17/70	17	7.7	8.5	12.5	29.1	103	86	Turbid, brown
Chatanika R. (above Tata- lina R. mouth)	11/19/70	--	6.6	2.5	12.5	--	86	--	Ice 5", snow 8", water depth 10'



TABLE 9 (Cont.) Water Quality Data\*, Minto Flats and Tanana River Drainage Lakes, 1968-1971.

<u>Water</u>	<u>Date</u>	<u>Surface Water Temp. °C</u>	<u>pH</u>	<u>D.O.</u>	<u>CO<sub>2</sub></u>	<u>Total Acid</u>	<u>Total Alkalinity</u>	<u>Hardness</u>	<u>Water Condition</u>
Chatanika R.	6/ 3/71	10	6.5	9.0	12.5	6.8	13	51	Very turbid, flooding
Chatanika R. above Gold- stream Cr.)	8/ 1/71	14	7.5	10.0	10.0	--	68	68	Clear, high
Goldstream Cr. (200' above mouth)	7/15/70	17	8.8	8.5	12.5	--	86	--	High, turbid
Goldstream Cr. (10' above mouth)	8/ 1/71	16	7.0	7.5	15.0	--	68	86	Turbid
Tatalina R. (200 yds above mouth)	7/17/70	14	8.3	10.5	12.5	39.3	86	86	Clear, brown
Tatalina R. (1 mi above mouth)	6/ 3/71	13	6.5	8.5	15.0	32.1	51	51	Flooding banks, turbid
Tolovana R. (50 yds above Chatanika R. confluence)	2/27/68	--	--	0.5	--	--	--	--	Ice 12", water depth 6'

<u>Water</u>	<u>Date</u>	Surface Water Temp. °C	<u>pH</u>	<u>D.O.</u>	<u>CO<sub>2</sub></u>	<u>Total Acid</u>	<u>Total Alkalinity</u>	<u>Hardness</u>	<u>Water Condition</u>
Tolovana R. (at Swanneck Slough)	2/27/28	--	--	2.0	--	--	--	--	Water dept 9'
Tolovana R. (mouth)	2/27/28	--	--	5.5	--	--	--	--	Water depth 15'
Tolovana R. (100 yds above Chata- nika mouth)	7/16/70	18	7.3	8.0	12.5	11.5	86	103	Clear, brown
Tolovana R. (100 yds above Chata- nika mouth)	7/31/70	16	8.4	8.5	10.0	11.5	103	86	Clear, brown
Tolovana R. (at R. I. S. mouth)	11/18/70	--	6.6	2.5	--	--	--	--	Ice 11", snow 10" water depth 10'
Tolovana R. (above Chata- nika mouth)	11/19/70	--	6.6	2.0	12.5	--	137	--	Ice 8", snow 7", water depth 8'
Tolovana R. (conf. of Swanneck Sl)	3/26/71	--	6.8	4.5	25.0	--	103	171	Ice 38", snow 15", water depth 48"

TABLE 9 (Cont.) Water Quality Data\*, Minto Flats and Tanana River Drainage Lakes, 1968-1971.

<u>Water</u>	<u>Date</u>	<u>Surface Water Temp. °C</u>	<u>pH</u>	<u>D.O.</u>	<u>CO<sub>2</sub></u>	<u>Total Acid</u>	<u>Total Alkalinity</u>	<u>Hardness</u>	<u>Water Condition</u>
Tolovana R. (above mouth)	3/26/71	--	8.7	1.5	35.0	--	120	--	Ice 28", snow 15", water depth 12'
Tolovana R. (8 mi below New Minto)	6/ 6/71	21	6.7	7.0	12.5	11.3	51	51	Clear, brown
Tolovana R. (2 mi below New Minto)	11/11/71	--	--	1.8	--	--	--	--	Ice 12", water depth 14'
<u>Other Tanana Waters</u>									
E. Twin L.	7/22/70	17	8.7	10.0	5.0	5.6	120	51	Clear
George L.	1/ 2/71	--	--	13.0	--	--	--	--	Ice 30", snow 4-6"
Healy L.	8/27/71	14	7.0	9.5	15.0	--	51	34	Clear, brown
Quartz L.	8/ 9/70	16	8.8	9.0	15.0	11.3	291	205	Clear
Volkmar L.	3/29/71	--	--	8.0	--	--	--	--	Ice 28", snow 18"
Wien L.	7/24/70	16	8.0	9.5	5.0	5.6	68	51	Clear
W. Twin L.	7/23/70	17	8.7	10.5	6.5	5.6	93	51	Clear

\*All data expressed in parts per million except pH.

\*\*May be high as sample taken from surface after agitation of drilling ice.

Water temperatures were monitored from May 17 through October 6 (Table 10). A maximum of 23°C was recorded in Rock Island Slough on July 8.

TABLE 10 Water temperatures, Minto Flats, 1971.

<u>Date</u>	<u>Temperature (°C)</u>				
	<u>Rock Island Slough</u>	<u>Tatalina River</u>	<u>Chatanika River</u>	<u>Tolovana River</u>	<u>Bear Paw Slough</u>
5/17	12	5	7	7	4
5/18	--	--	4	7	--
5/22	7	7	4	7	6
6/ 3	13	--	--	--	--
6/ 4	14	--	--	--	--
6/ 6	21	18	--	--	--
7/ 8	23	21	19	20	--
7/19	--	16	16	17	--
7/20	--	--	--	--	21
7/23	--	17	16	--	19
7/24	--	19	16	19	--
9/ 8	--	--	7	--	--
9/ 9	--	--	7	--	--
9/10	7	--	--	--	--
9/21	7	6	6	--	--
9/22	8	--	6	--	--
10/ 4	1	--	1	0	--

## Food Habits

Stomachs of 212 pike taken in 1971 from the Minto Flats were analyzed (Table II). Of the 167 pike taken between May and September, 58 (34.7%) had empty stomachs. Of the remaining 109 stomachs, 67 (61.5%) contained vertebrates and 42 (38.5%) contained invertebrates. Stomachs of 45 pike taken between November 19 and December 9, showed 22 (49%) empty. Of the remaining 23 stomachs, 21 (91.3%) contained fish remains and 2 (8.7%) contained invertebrate remains.

TABLE II Stomach Contents of 132 Pike from Minto Flats, 1971.

<u>Food Item</u>	<u>May-Sept (n=109)</u>		<u>Nov. 19-Dec. 9 (n=23)</u>	
	<u>No. of Stomachs</u>	<u>%</u>	<u>No. of Stomachs</u>	<u>%</u>
Vertebrates:				
Pike	26	23.9	17	73.9
Whitefish	7	6.4	0	0.0
Burbot	6	5.5	0	0.0
Blackfish	3	2.8	4	17.4
Sucker	1	0.9	0	0.0
Frog ( <i>Rana</i> sp.)	2	1.8	0	0.0
Unidentified fish remains	22	20.2	0	0.0
Invertebrates:*				
Tadpole shrimp (Notostraca)	17	15.6	0	0.0
Amphipod ( <i>Gammarus</i> sp.)	7	6.4	0	0.0
Dragonfly (Odonata)	3	2.8	0	0.0
Beetle (Coleoptera)	3	2.8	0	0.0
Water flea (Cladocera)	3	2.8	0	0.0
Seed shrimp (Ostracoda)	2	1.8	0	0.0
Unidentified inverte- brate remains	7	6.4	2	8.7

\*Single occurrences of copepods, water bugs, caddis flies, midges, and snails were also noted.

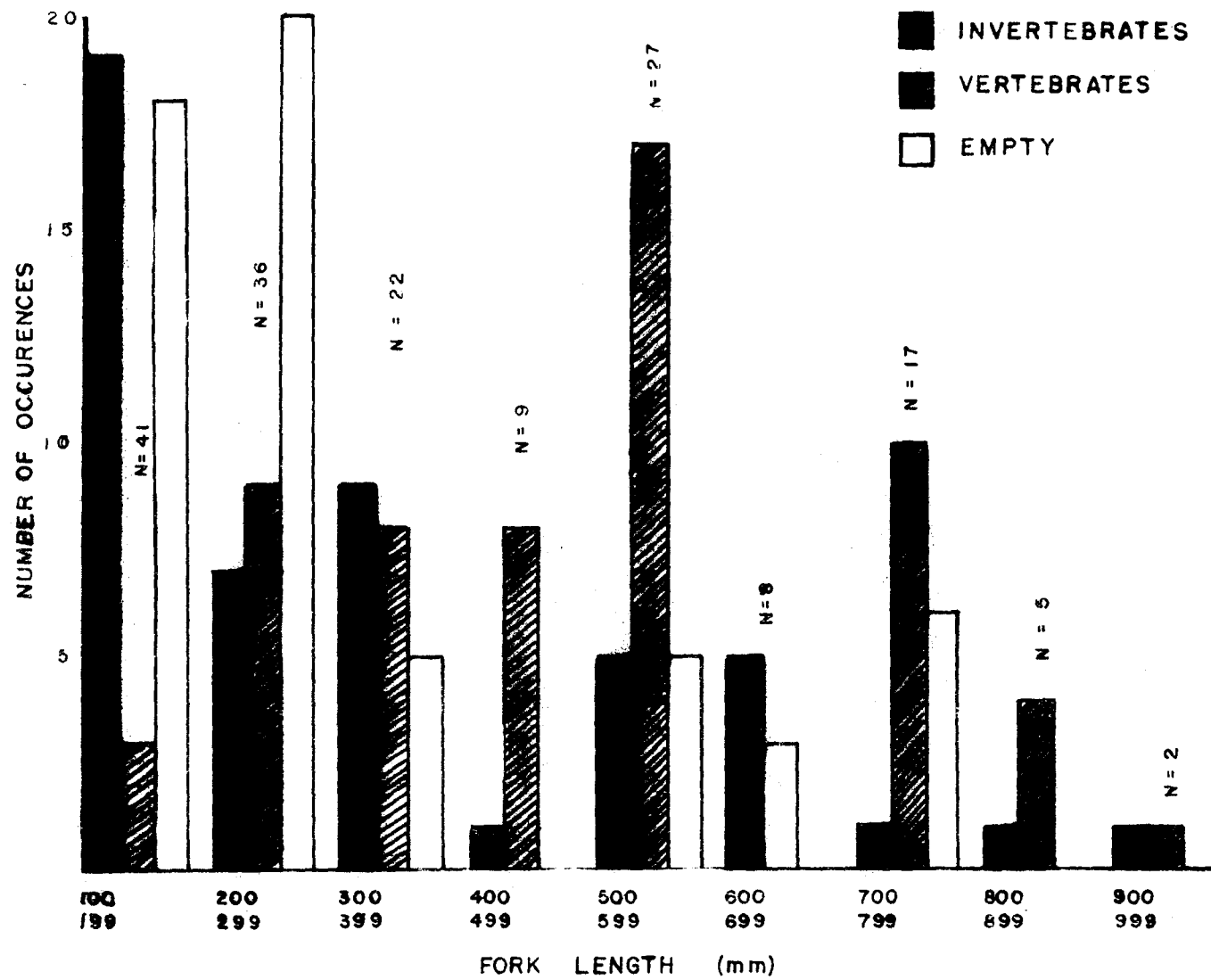


FIGURE 3 FOOD TYPE OF MINTO FLATS PIKE BY LENGTH GROUPS, 1970-1971.

Twenty-two of 26 pike stomachs from Healy Lake were empty while two each contained fish remains and invertebrate remains. Twenty-three of 30 pike stomachs examined from George Lake were empty and the remaining seven contained whitefish.

In 1970, 74% of Minto Flats pike stomachs contained vertebrates while 30.9% contained invertebrates (Cheney, 1971). In 1971, the percentage occurrence was 69.8% vertebrates and 38.9% invertebrates. In 1971, pike consumed a larger variety of invertebrates than in 1970. However, the most important prey item in 1971 for Minto Flats pike was smaller pike.

Pike up to 200 mm feed predominantly on invertebrates in Minto Flats (Figure 3). Larger fish consume more vertebrates, and fish over 400 mm eat invertebrates only incidentally.

## LITERATURE CITED

- Alt, Kenneth T. 1969. Sheefish and Pike Investigations of the Upper Yukon and Kuskokwim Drainages with Emphasis on Minto Flats Drainages. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1968-1969, Project F-9-1, 10:353-368.
- \_\_\_\_\_. 1970. Sheefish and Pike Investigations of the Upper Yukon and Kuskokwim Drainages with Emphasis on Minto Flats Drainages. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1969-1970, Project F-9-2, 11:321-330.
- Cheney, William L. 1971. Life History Investigations of Northern Pike in the Tanana River Drainage. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1970-1971, Project F-9-3, Vol. 12, Study R-11, 24 pp.
- Hatfield, C. T., et al. 1972. Fish Resources of the Mackenzie River Valley. Canadian Fisheries Service. Interim Report Vol. 1:95-99.
- Hubbs, Carl L. and Karl F. Lagler. 1958. Fishes of the Great Lakes Region. Cranbrook Institute Science Bull. No. 26. Revised Ed. 213 pp.
- Miller, R. B. and W. A. Kennedy. 1948. Pike (Esox lucius) from Four Northern Canadian Lakes. Journal of the Fisheries Research Board of Canada, 7(4):190-199.
- Morrow, James E. 1964. Populations of Pike, Esox lucius, in Alaska and Northeastern North America. Copeia, No. 1, March 26, pp. 235-236.
- Peckham, Richard D. 1972. Inventory and Cataloging of the Sport Fish and Sport Fish Waters in Interior Alaska. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1971-1972, Project F-9-4. In Press.

Roguski, Eugene A. and Peter C. Winslow. 1969. Investigations of the Tanana River and Tangle Lakes Grayling Fisheries: Migratory and Population Study. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1968-1969, Project F-9-1, 10:333-351.

Van Hulle, Frank D. 1968. Investigations of the Fish Populations of the Chena River. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1967-1968, Project F-5-R-9, 9:287-304.

Williams, J. E. 1955. Determination of Age from the Scales of Northern Pike (Esox lucius L.). Ph.D. Thesis, University of Michigan.

*Prepared by:*B:

*Approved by:*

William L. Cheney  
Fishery Biologist

s/Howard E. Metsker  
D-J Coordinator

*Date:* April 30, 1972.

s/Rupert E. Andrews, Director  
Division of Sport Fish